

REMARKS

Applicants appreciate the Examiner's thorough examination of the subject application and request reconsideration of the subject application based on the foregoing amendments and the following remarks.

Claims 1-7, 9, 10, 12 and 14 are pending in the subject applications. Claims 3-6, 9-10 and 12 stand rejected under 35 U.S.C. §112, second paragraph. Claims 3 and 7 stand rejected under 35 U.S.C. §103(a) over Hashimoto et al Publication and Mitsuho et al "Handbook of Distillation Engineering". Claims 4-6, 9-10 and 12 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. §112, second paragraph. Claims 1-2 and 14 are allowed.

Claims 3, 4, 7, 9, 10 and 12 have been amended herein. No new matter has been added by virtue of these amendments, support for which is provided in the original claims of the application and throughout the application as filed.

Regarding claim 7, Applicants previously amended claim 7 in a Response After Final Rejection to state that "the plurality of perforated trays without downcomer disposed respectively at vertically adjacent spacing have a blind ratio of not less than 0.2 and not more than 1". In the April 14, 2003 Advisory Action, the Office indicated that this amendment would provoke a new 112 rejection because this is nowhere in the specification. Applicants again submit this amendment to claim 7 and respectfully submit that support for this amendment is found on page 26, line 16 to page 27, line 2 and Figure 7. In these portions of the specification, the blind ratio is defined as " $1-(S/T)$ ". S is the sum of the areas where the holes of the upper one of two adjacent perforated trays overlap those of the lower perforated tray, and T is a smaller one of the sum of the areas of the holes of the upper perforated tray and the sum of the areas of the holes of the lower perforated tray. S has a minimum value of "0" (no overlap) and a maximum of "T". Thus, the blind ratio takes a value from 0 to 1 inclusive.

1. 35 U.S.C. §112 Rejections

Claims 3-6, 9-10 and 12 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

The Office states that "Claim 12 is an incomplete claim as it depends on a cancelled claim 11." Claim 12 has been amended as requested. Reconsideration and withdrawal of the rejection is respectfully requested.

The Office further states that "Claim 3 is incomplete with the comma, and not a period after the recitation of '3d'." Claim 3 has been amended as requested. Reconsideration and withdrawal of the rejection is respectfully requested.

The Office further states that "Claim 3 is rejected for the same reason as set forth at page 2, section (a), 1., of the previous Office Action." In particular, in the previous Office Action, the Office stated that "It is unclear what constitutes the following claimed limitations within the context of the claimed invention. 1. The 'd' in claim 3". Applicants respectfully submit that claim 3 clearly indicates what constitutes the "d" in claim 3. In particular, claim 3 reads that "each of the plurality of holes has a diameter d". Thus, "d" is the diameter of each of the plurality of holes. Accordingly, reconsideration and withdrawal of the rejection is respectfully requested.

in grants specifying the value of d - one hole out of a number of holes

The Office further states that "The punctuation mark (!) after 'to' in claim 4, line 11 is a typographical error." Claim 4 has been amended as requested. Reconsideration and withdrawal of the rejection is respectfully requested.

The Office further states that

It is unclear whether the "an easily polymerizable compound or a liquid..." recited in the wherein clause of claim 9 is the same or different from the compounds initially recited in lines 1-3 of claim 9. (Underlinings Supplied). Also, the limitation in the "wherein" clause is already recited in claim 9, lines 1-3 claimed twice?

Claim 9 has been amended to delete the "wherein" clause. Thus, rejection of this claim is now moot.

The Office further states that "In claim 10, line 2, 'distillation step' should be distilling step – to be consistent since claim 9, the claim from which it depends recite the later. Claim 10 has been amended as requested. Reconsideration and withdrawal of the rejection is respectfully requested.

Applicants respectfully submit that all the claims comply with 35 U.S.C. §112.

2. 35 U.S.C. §103 Rejections

Claims 3 and 7 have been rejected under 35 U.S.C. §103(a) as being unpatentable over the Hashimoto et al Publication (Properties of Perforated Trays Devoid of Downcomers) and Mitsuho et al "Handbook of Distillation Engineering".

Applicants respectfully traverse.

Applicants claim, in claim 3, a perforated tray without downcomer in a perforated tray tower without downcomer wherein the tower comprises a plurality of perforated trays without downcomer disposed respectively at a plurality of stages. Further, each of the plurality of perforated trays without downcomer is provided with a plurality of holes, wherein each of the plurality of holes has a diameter d in a range of from 10mm to 25mm, and each of the plurality of holes is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$. Still further, when two or more of the plurality of perforated trays without downcomer are used at the same stage, the two most closely located holes that respectively belong to adjacent perforated trays are separated from one another by a center-to-center distance in a range of from 50mm to 150mm.

In the BACKGROUND OF THE INVENTION section of the present specification, the prior art perforated tray towers without downcomer disclosed by Hashimoto et al and Mitsuho et al are described **including their problems**. More specifically, that section states:

in some cases, distillation of, for example, (meth)acrylic acid, using the conventional perforated tray tower without downcomer [as disclosed in the documents -- author] causes formation of a polymer which should be removed manually or chemically after suspension of the operation.

It is further explained that the conventional perforated trays without downcomer designed to address these problems **fail** to concurrently and surely produce both the **first state** where the inside of the perforated tray tower without downcomer is made wet with a liquid containing an easily polymerizable compound **and** the **second state** where gas and/or liquid currents are prevented from channeling and stagnating.

Therefore, it would not have been obvious to one of ordinary skill in the art to combine the descriptions in *Properties of Perforated Trays Without Downcomer* and *Distillation Engineering Handbook* and arrive at the present invention of a perforated tray without downcomer **wherein each of the plurality of holes has a diameter d and is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$** . There is no suggestion in these references or their combination for such structure **wherein each of the plurality of holes has a diameter d and is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$** . This structure of the perforated tray without downcomer, as presently claimed, is capable of *concurrently* and surely providing the **first state** where the inside of the perforated tray tower without downcomer is made wet with a liquid containing an easily polymerizable compound **and the second state** where gas and/or liquid currents are prevented from channeling and stagnating, **thereby preventing the formation of polymers with better efficiency**, and distilling an easily polymerizable compound in a stable manner over an extended period of time.

In other words, the perforated tray without downcomer of the present invention has unique elements (values and conditions), as set forth in the claims, that are not taught nor would they have been obvious to one of ordinary skill in the art based on the cited prior art. None of the cited art, alone or in combination, teach or suggest

making the holes in the tray with a center-to-center distance in a range from 1.2d to 3d.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). MPEP 2142.

As set forth above, Hashimoto et al Publication (Properties of Perforated Trays Devoid of Downcomers) and Mitsuho et al "Handbook of Distillation Engineering". clearly do **not** teach or suggest all the claim limitations. Accordingly, claim 3 is patentable over Hashimoto et al and Mitsuho et al.

Claim 7 has been amended herein and now depends from claim 4. The Office has indicated that claims 4-6, 9-10 and 12 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. §112, second paragraph. Applicants respectfully submit that these claims have been amended herein, as suggested. Accordingly, it is believed that these claims are allowable. Claim 7 depends from claim 4 and, likewise is believed to be allowable.

3. Allowable Claims

The Office has indicated that claims 1-2 and 14 are allowed. The Office has further indicated that claims 4-6, 9-10 and 12 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. §112, second paragraph.

Applicants have amended the claims as required under 35 U.S.C. §112, second paragraph. Accordingly, it is believed that these claims are now allowable.

CONCLUSION

Reconsideration and allowance of claims 1-7, 9, 10, 12 and 14 is respectfully requested in view of the foregoing discussion. This case is believed to be in condition for immediate allowance. Applicants respectfully requests early consideration and allowance of the subject application.

Should the Examiner wish to discuss any of the amendments and/or remarks made herein, the undersigned attorney would appreciate the opportunity to do so.

Respectfully submitted,



Lisa Swiszczy Hazzard (Reg. No. 44,368)
EDWARDS & ANGELL, LLP
P.O. Box 9169
Boston, MA 02209
Tel. No. (617) 517-5512



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VERSION WITH MARKINGS TO SHOW CHANGES MADE IN CLAIMS

Please note that additions to the claims are shown underlined and deletions are shown in brackets.

Please amend claims 3, 4, 7, 9, 10 and 12 as follows:

3. A perforated tray without downcomer in a perforated tray tower without downcomer;

said tower comprising a plurality of perforated trays without downcomer disposed respectively at a plurality of stages, each of the plurality of perforated trays without downcomer being provided with a plurality of holes, wherein

each of the plurality of holes has a diameter d in a range of from 10mm to 25mm, and each of the plurality of holes is separated from an adjacent hole by a center-to-center distance in a range of from 1.2d to 3d,

wherein, when two or more of the plurality of perforated trays without downcomer are used at the same stage, the two most closely located holes that respectively belong to adjacent perforated trays are separated from one another by a center-to-center distance in a range of from 50mm to 150mm.

4. A perforated tray tower without downcomer, comprising a plurality of perforated trays without downcomer disposed respectively at a plurality of stages, each of the plurality of perforated trays without downcomer being provided with a plurality of holes, wherein

each of the plurality of holes has a diameter d in a range of from 10mm to 25mm,

the perforated tray without downcomer has a thickness in a range of from 2mm to 8mm,

the perforated tray without downcomer has an opening ratio in a range of from 10% to 30%, and

each of the plurality of holes is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$,

wherein, when two or more of the plurality of perforated trays without downcomer are used at the same stage, the two most closely located holes that respectively belong to adjacent perforated trays are separated from one another by a center-to-center distance in a range of from 50mm to 150mm.

7. [A perforated tray tower without downcomer, comprising a plurality of perforated trays without downcomer disposed respectively at a plurality of stages] The perforated tray tower without downcomer according to claim 4, wherein

the plurality of perforated trays without downcomer disposed respectively at vertically adjacent spacing have a blind ratio of not less than 0.2 and not more than 1 [at least 0.2].

9. A method of distillation, comprising the step of distilling an easily polymerizable compound or a liquid containing an easily polymerizable compound, using a perforated tray tower without downcomer, comprising a plurality of perforated trays without downcomer disposed respectively at a plurality of stages, each of the plurality of perforated trays without downcomer being provided with a plurality of holes, wherein

each of the plurality of holes has a diameter d in a range of from 10mm to 25mm,

the perforated tray without downcomer has a thickness in a range of from 2mm to 8mm,

the perforated tray without downcomer has an opening ratio in a range of from 10% to 30%₀, and

each of the plurality of holes is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$,

wherein, when two or more of the plurality of perforated trays without downcomer are used at the same stage, the two most closely located holes that

respectively belong to adjacent perforated trays are separated from one another by a center-to-center distance in a range of from 50mm to 150mm[,

wherein an easily polymerizable compound or a liquid containing an easily polymerizable compound is distilled].

10. The method of distillation as defined in claim 9, wherein the [distillation] distilling step is carried out under at least one of first and second conditions,

the first condition being such that an amount of wetting liquid with respect to a cross-sectional area of the tower is at least $0.3\text{m}^3/\text{m}^2 \cdot \text{h}$, and

the second condition being such that an amount of wetting liquid with respect to a sum of areas of the plurality of holes is at least $1\text{m}^3/\text{m}^2 \cdot \text{h}$.

12. The method of distillation as defined in claim 9 [11], wherein

the easily polymerizable compound is at least one compound selected from the group consisting of (meth)acrylic acid and esters thereof.